Bryophyta

- Bryophytes Produce embryos but lack seeds and vascular tissues
- Bryophytes are represented by 960 genera and 24,000 species.

GENERAL CHARACTERS

1. Plant body is gametophytic, independent, dominant, autotrophic, either thalloid (i.e., thallus like, not differentiated into root, stem and leaves) or folise containing a rootless leafy shoot.

2. Plant body is very small and ranges from a few mm. to many cm. Zoopsis is the smallest bryophyte (5 mm.) while the tallest bryophyte is Dawsonia (50-70 cms.).

3. Leaves and stems found in vascular plants are absent, Koch (1956) termed these 'leaf and 'stem' like structures as 'axis' and 'phylloid' respectively.

4. Roots are absent. Functions of the roots are performed by rhizoids. Cells are also capable to absorb moisture directly from the ground or atmosphere. Therefore, Bryophytes can also survive on the moist soils.

5. Rhizoids may be unicellular, unbranched (e.g., Riccia, Marchantia, Anthoceros) or multicellular and branched (e.g., Sphagnum, Funaria).

6. In members of order Marchantiales (e.g., Riccia, Marchantia) scales are present. These are violet coloured, multicellular and single cell thick. They protect the growing point and help to retain the moisture.

7. Vascular tissue (xylem and phloem) is completely absent. Water and food material is transferred from cell to cell. However, in some Bryophytes (e.g., mosses) a few cells in groups of 2-3 are present for conduction of water and food (photoassimilate).

Pteridophyta

They are Represented by about 400 living and fossil genera and some 10,500 species .

GENERAL CHARACTERS

(i) Majority of the living Pteridophytes are terrestrial and prefer to grow in cool, moist and shady places e.g., ferns. Some members are aquatic (e.g., Marsilea, Azolla), xerophytic (e.g., Selaginella rupestris, Equisetum) or epiphytic (e.g.. Lycopodium squarrosum) (Fig. 1).

(ii) Majority of the Pteridophytes are herbaceous but a few are perennial and tree like (e.g., Angiopteris). Smallest Pteridophyte is Azolla (an aquatic fern) and largest is Cyathea (tree fern).

(in) Plant body is sporophytic and can be differentiated into root, stem and leaves.

(iv) Roots are adventitious in nature with monopodial or dichotomous branching. Internally usually they are diarch.

(v) Stem is usually branched. Branching is monopodial or dichotomous. Branches do not arise in the axil of the leaves. In many Pteridophytes stem is represented by rhizome.

(vi) Leaves may be small, thin, scaly (microphyllous e. g., Equisetum), simple and sessile (e.g.,Selaginella) or large and pinnately compound (megaphyllous e.g., Dryopteris, Adiantum). (vii) Vascular tissue is present in stem and root. It consists of xylem and phloem. Xylem consists of tracheids only and phloem has only sieve tubes.

(viii) The stele is protostele (e.g., Rhynia, Lycopodium), siphonostele (e.g.Equisetum), dictyostele (e.g., Pteris, Adiantum) or polycyclic (e.g., Angiopteris).

(ix) Cambium is absent, hence, they donot show secondary growth.

Gymnosperms

GENERAL CHARACTERS

External Features

1. Gymnosperms are predominantly woody plants, represented by trees, shrubs or rarely climbers.

2. They are usually xerophytic, some of them are deciduous while others are evergreen. Sequoia sempervirens (California or Coast red wood) is probably the tallest living tree reaching a height nearly 112 m and attaining a growth of 15 m. Smallest gymnosperm is Zamia pygmaea. It is 25 cm tall.

3.The bristlecone pines (three species of pines i.e., P. aristata, P. longaeva and P balfouriana) are thought to reach an age greater than that of any other single organism known, upto nearly 5000 years. . Plant body is sporophytic and can be differentiated 3 into root, stem and leaves.

4. Generally the plants possess well developed tap root system. In some gymnosperms the roots show symbiotic relationship e.g., coralloid roots of Cycas with algae and mycorrhizal roots of Pinus with fungi.

5. Stem is erect, woody and branched (unbranched in Cycas and tuberous in Zamia). Presence of leaf scars on the stem is the characteristic feature of gymnosperms.

6. The arrangement of the leaves on the stem may be spiral or cyclic. They may be of one kind (monomorphic) or two kinds (dimorphic, foliage leaves and scale leaves). Foliage leaves are green, simple, may be small (microphyllous e.g., Pinus) or large (megaphyllous e.g., Cycas). Their main function is photosynthesis. Scale leaves are present around the reproductive structures and apex. They are mainly protective in nature.

Internal Structure

1. The roots are diarch to polyarch.

2.In stem a well developed vascular system is present in the form of vascular bundles. The vascular bundles are open, endarch and are arranged in a ring.

3. Secondary growth takes place in the gymnosperms and there is the formation of annual rings.

4. The xylem is composed of tracheids with border pits and xylem parenchyma.

5. Secondary wood is of two types: manoxylic (porous and loose due to presence of large amount of parenchyma and broad medullary rays e.g., Cycas, useless commercially) and pycnoxylic (compact and hard due to less amount of parenchyma and narrow medullary rays e.g., Pinus). Bordered pits may be uniseriate or multiseriate.

6. Like pteridophytes, in the wood xylem vessels and fibres are absent (except in Gnetales).

7. Phloem is composed of sieve tubes and phloem parenchyma. Companion cells are completely absent.

8. Leaves are characterised by the presence of thick cuticle and sunken stomata.

9. Mesophyll tissue may be differentiated into palisade tissue and spongy parenchyma e.g., Cycas or remain undifferentiated e.g., Pinus, Cedrus etc.

10. Lateral veins are absent in most of the gymnosperms. So, the translocation of the nutrients takes place with the help of transfusion tissue.

GENERAL ACCOUNT OF CYCADOFILICALES (PTERIDOSPERMALES)

ORIGIN OF CYCALOFILICALES

- The Cycadofilicales of Pteridospermales are popularly known as seed ferns.
- They were trees or small plants bearing fern like foliage.
- They flourished generally in the carboniferous and the period was so very rich in fossil fern leaves that it was thought to be the age of ferns.
- Owing to the presence of fern like leaves they were formerly believed to be a kind of fern but subsequently when fossil leaves with attached seeds were discovered in 1903, the Cycadofilicales were designated as pteridosperms by Oliver and Scott.
- They are regarded as primitive group of seed plants.

Characteristic Features of Cycadofilicales

- Plants were trees or small plants with monopodial branching and presence of ramentum.
- Leaves were large and fern like bearing micro-and megasporanagia.
- Leaf traces relatively large. single or double.
- Leaves possessed resistant cuticle.
- Primary xylem well developed, usually mesarch or endarch.
- Secondary xylem and phloem and a large pith present.

Spore Producing Organs

- The pollen bearing organs were exannulate sporangia.
- Either the leaf or specially modified frond i.e. megasporophyll bear ovule or seed.
- The male reproductive structures were clustered probably in the form of synangia at the apices of the branches.
- A well developed vascular supply was present in the seed and the latter was also provided with a definite pollen chamber.
- Strobili were absent.
- The megaspores were surrounded by a thick wall.
- The microsporangia had no annualus and were sometimes grouped by synangia.
- The seeds of this group resemble with those of present day cycads.

Classification

Arnold (1947) divided this group into three families:

1. Lyginopteridaceae, e.g., Lyginopteris.

2. Medullosaceae, e. g.. Medullosa

3. Calamopityaceae, e.g.. Calamopitys

Palaeobotany

Palaeobotany is the study of fossil plants. These fossils are found in the layers of earth and certain layers of rocks . It is also spelled as palaeobotany . It is the branch of paleology.
Stenbery(1761- 1838) is known as the Father of Palaeobotany.

TYPES OF FOSSILS

Fossil can be defined as the remains (or an impression) of a plant or animal that has been excavated from the soil. On the basis of the nature of fossilization the fossils may be of following types.

1. **Petrified fossils**: The word petrifaction means turning into stones. The fossils form when minerals replace all or the parts of the organisms .

2. **Molds and Casts**: A mold forms when hard parts of an organism are burried the sediment such as sand, silt or clay.
3. **Carbon films** : All living things contain an element carbon. When an organism dies and is burned in sediment, the materials that make the organism break down and eventually only the carbon remains.
4. **Prace fossils:** These fossils show the activities of the organis. An animal makes a foot print when it stepe in sand.
5. **Preserved Remains** :Some organisms are preserved in or close to their original states. These fossils are called preserved remains e.g - an organism such as an insect is trapped in a tree's sticky resin and dies.
6. **Compression** : This type of fossil is common in the sedimentary deposits of rocks. It is a sort of impression where most of the organic remains of the plant remain in the fossil state.
7. **Impression :** These fossile are just impression of plants or plant parts on sediments.
8. **Pseudofossils :** Sometimes watery solutions of various minerals speed through the sediments and it take the shape of some plant part or animal. Such fossils are called pseudofossils

Modifications of Root

A non – heritable change lasting only as long as the operative conditions last is called modification. Modification take place to perform special functions.
It can be divided into following types

1. Modification of tap root for storage of food .
2. Modification of tap root for vital functions.
3. Modification of adventitious root for storage of food.
4. Modification of adventitious root for mechanical support.
5. Modification of adventitious root for vital functions.

1.Modification of tap root for storage of food : It is the following types

I. Fusiform root , eg: - Radish
II. Napiform root , eg - Turnip
III. Conical root, eg- Carrot
IV. Tuberous root, eg – Mirabilis jalapa

2. Modification of tap root for vital functions : It is the following types

I. Nodulated tap root eg : Pea
II. Pneumatophores or Respiratory roots : eg : Heritiera littoralis

3. Modification of adventitious root for storage of food : It is the following types

I. Tuberous root : eg- Sweet potato
II. Fasciculated roots , eg- Dahlia
III. Nodulose root , eg- Turmeric
IV. Moniliform of beaded root, eg – Momordica
V. Annulated root , eg- Ipecac

4.Modification of adventitious root for mechanical support : It is the following types

I. Prop roots, eg- Banyan
II. Stilt Roots, eg- Sugarcane
III. Climbing roots, eg- Betel
IV. Buttress roots , eg- silk cotton tree

5. Modification of adventitious root for vital functions : : It is the following types

I. Photosynthetic Roots , eg- water chestnut
II. Epiphytic Roots , eg – vanda
III. Clinging Roots , eg- Orchid
IV. Sucking Roots, eg- Mistletoe
V. Floating Roots , eg- Kessra
VI. Leaf Roots , eg- Bryophyllum

Meristematic Tissues

- Meristems are cell population that retain the properties of embryonic Matus, principally the capacity to divide and produce new cells.
- Meristem in most plants containing undifferentiated cells (neristematic cells or meristems) found in zones of the plant where growth takes place. Meristemetic cells give rise to various organs of the giant and keep the plant growing.
- The term meristem was first used by Karl Wihelm von Nägeli (1656) in his book Beitrage Zur Wissenchaftlichen Botanik (Contributions to Scientific Botanys).

characteristic of Meristematic Cells

1. Meriatematac cells are thin walled parenchymatous cells may be rounded.oval ,polygonal or rectangular in shape and usually isodiametric.
2. Their thin ware made up of cellulose
3. There are no intercellular space between them. So, they are compactly arranged.
4. They have dense cytoplasm with prominent nucleus.
5. In the cells, varies are either small or the vacuoles may be altogether absent.
6. The cells do not store reserve food material.
7.These cells do not have ergastic substances and have smaller amount of endoplasmic reticulum.
8. The plastids are in the proplastid stage. The plastides may be present in secondary meristems.
9. Cytochemical studies showed the presence of enzyme peroxidase in the meristematic tissue.
10. The cells are in active state of metabolism.

PLANT EMBRYOLOGY

INTRODUCTION

- The study of the formation and development of embryo is known as embryology.
- It includes the study of proceses such as structure and developmend productive organs, gamete formation, fertilization, embryo development and formation of a new plant.
- The spermatophytes (end bearing plantes are divided into two main groups: Gymnosperms and Angiosperms. The angiosperms are the highest evolved plants.

MICROSPOROGENESIS

- Inside the anthers formation of pollengrains or microspores from the microspore mother cells is known as microsporogenesis. Each microspore mother cell divides meiotically to form four haploid microspores or pollen grains.
- The outgrowth on the apex differentiates into a microspore bearing portion, anther, connective and a slender stalk, the filament . The microsporangia develop in young anther. The development of microspolangium is Eusporangiate type.

ovule

An outgrowth of the ovary of a seed plant that after fertilization develops into seed is called ovule . Or

A structure in seed plants that consists of the embryo sac (containing the egg cells) surrounded by the nucellus and one or two integuments and that develops into a seed after it is fertilized is called ovule.

Palynology

- Palynology is the study of Plant pollens , spores and water microscopic plankton organisms collectivery termedas palynomorphs.
- Palynology term was coined by **Hyde** and **Williams**

Structure of Pollen Grain

- Pollen is a powdery substance consisting of pollen grains which are generally spherical and produce male gametes.
- Pollen grains vary in shape, size, and surface characteristics and are used to classify the different species.
- Pollen grains of pines for and spurces are winged. The smallest pollen grain is of Myrostis spp. (Forget me not) is 2.5 to 5 cm (.005 nm) in diameter. Average size of pollen is 25 but some may be large as 200 µ. Zostira known to have with longest pollen grains till now, with pollen grains upto 2500 µm long.
- A mature pollen grain has a two layered wall, the outer wall exine and the inner wall in Intine (called sporoderm).
- Exine is hard outer layer made up of sporopolenin and intine is made up of Cellulose and Pectin.
- Exine is differentiated into endexine and exexine.
- The wall encloses a large vegetative cell containing vegetative nucleus and a lenticular generative cell.